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Dewi Indah Sari Siregar, *et.al*. Association between allergic rhinitis

Association between allergic rhinitis, eosinophilia and helminth infection in Alwasliyah Berastagi elementary school students

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Abstract

Introduction Eosinophils can regulate local immune and inflammatory responses, and their accumulation inside blood and tissue has long been associated with parasitic infestation and allergic inflammation. The prevalence of allergic rhinitis and helminth infection in children relatively increases every year. The burden of allergic rhinitis and helminth infection is mainly attributed to the quality of life of those infected. The latest study shows that an increase in eosinophil progenitors is important in diseases associated with eosinophilia. Objective: The community service was established to find the distribution of allergic rhinitis, eosinophilia, and helminth infection among students in Alwasliyah Berastagi Elementary School and to determine the association between allergic rhinitis and eosinophilia in helminth infection. In addition, this service is also aimed at increasing student's knowledge about the association between allergic rhinitis and eosinophilia in helminth infection and how to prevent it. Method: We did the ENT examination, routine blood test, and routine stool examination to 43 students and gave the students education about the association between allergic rhinitis and eosinophilia in helminth infection and how to prevent it. Result: The prevalence of allergic rhinitis, eosinophilia, and helminth infection was 53.5%, 19.5%, and 13%. The highest prevalence of allergic rhinitis is among 11 years old age group and female students (52.5%, 60.9%). The highest prevalence of eosinophilia is among 11 and 12 years old age group both accounting 37.5%. The highest prevalence of helminth infection is in 10 and 12 years old age group (66.7%, 33.3%). Both eosinophilia and helminth infection are higher among male than female students (62.5% and 66.7%). There were more students with a corrected answer that we classify as good knowledge after they were educated than before they were educated. (93% vs 79.1%) Conclusion: There was no significant association between allergic rhinitis, helminth infection, and eosinophilia ($p = 0.587$ and $p = 0.458$, $p > 0.05$).

Keyword: Eosinophilia, allergic rhinitis, helminth infection

1. INTRODUCTION

Allergic rhinitis is an inflammatory process in the nasal mucosa mediated by IgE due to allergic reactions in individuals who have previously been sensitized with the same allergens. It is one of the most common atopic diseases and chronic disorders of childhood. Allergic rhinitis is the most common type of chronic rhinitis, affecting 10–20% of the population and evidence suggests that the prevalence of the disorder is increasing (Dykewicz & Hamilos, 2019). Its incidence has also increased over the past several decades in developed as well as developing countries for reasons that are poorly understood. In Indonesia, the prevalence of allergic rhinitis in children aged 6 to 7 years and 13 to 14 years to be 3.6% and 6.4%, respectively and relatively increases every year (Mallol *et al.,* 2013). Sneezing, runny nose, nasal congestion, itchy eyes and lacrimation are typical symptoms of allergic rhinitis (Small, Keith & Kim, 2018).

Allergic rhinitis involves interactions between the environment and predisposition genetic in the development of the disease. Genetic and hereditary factors play a role in the expression of allergic rhinitis. The most common etiology of allergic rhinitis is inhalant allergens in adults and

ingestions in children. Allergic rhinitis in children often accompanied by other allergic symptoms, such as urticaria and indigestion (Small, Keith & Kim, 2018).

Allergic rhinitis has been categorized as seasonal (occurs during a specific season) or perennial (occurs throughout the year). However, allergic rhinitis is now classified according to symptom duration (intermittent or persistent) and severity (mild, moderate or severe) due to the previous classification is not fit to all patients (Dykewicz & Hamilos, 2019).

The Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines have classified "intermittent" allergic rhinitis as symptoms that are present less than 4 days per week or for less than 4 consecutive weeks, and "persistent" allergic rhinitis as symptoms that are present more than 4 days/week and for more than 4 consecutive weeks. Symptoms are classified as mild when patients have no impairment in sleep and are able to perform normal activities (including work or school). Symptoms are categorized as moderate/ severe if they significantly affect sleep or activities of daily living, and/or if they are considered bothersome. It is important to classify the severity and duration of symptoms as this will guide the management approach for individual patients.

The diagnosis of rhinitis is essentially clinical. A family history of allergy, seasonal variation of symptoms, the fact that ocular and nasal symptoms coincide and a link to exposure to epithelia, pollen and dust are clinical data that are diagnostically highly predictive when AR is suspected. In the etiological diagnosis of allergic rhinitis the most cost-effective analyses are prick and/or in vitro specific serum IgE tests (Min, 2010).

The soil-transmitted helminth (STH) is an intestinal worm that infects humans which are transmitted through contaminated soil consisting of Ascaris lumbricoides, Trichuris trichiura, Ancylostoma duodenale and Necator americanus. More than 1.5 billion people or 24% of the world's population are infected by helminth infection. Most infections occur in tropical and subtropical regions, especially in Africa, America, China and East Asia (WHO, 2019). More than 267 million children at preschool age and more than 568 million school-age children live in areas potentially infected with soil transmitted helminth and need care and prevention (WHO, 2019). The prevalence of worm infections in Medan is quite high, where there are 7.6% of students in one of the public elementary schools in Medan who suffer helminth infection (Arrasyid *et al.*, 2017).

Eosinophilia is a condition where the number of blood eosinophils is greater than 450 cells per microliter. This condition is associated with a variety of disorders including allergies and worm infections. Eosinophils can regulate local immune and inflammatory responses, and their accumulation in the blood and tissue is associated with several inflammatory and infectious diseases (Fulkerson & Rothenberg, 2013). Eosinophil-rich inflammation has long been associated with parasitic infestation and allergic inflammation. In cases of allergies, eosinophils will increase. In the body, IgE on the surface of basophil cells and mast cells will react if it occurs on repeated exposure by the same allergen. Release of mediators such as histamine, bradykinin, eosinophil chemotactic of anaphylaxis (ECF-A), a slow-reacting factor of anaphylaxis (SRS-A) and degranulation of mast cells then occurs. The presence of histamine and ECF-A will cause the release of eosinophils from the bone marrow into the blood circulation (Nadif *et al.*, 2014).

Increased levels of IL-4, IL-5, IL-13 accompanied by elevated levels of IgE and eosinophils are Th2 responses that occur due to helminth infections and allergic diseases such as allergic rhinitis. The hygiene hypothesis states that a lack of exposure to the infectious agent causes the body's immune response to be less activated by Th1, which leads to a Th2 response. In tropical countries, infections often occur and are chronic so that Th1 is often activated and the body's immune response does not lead to Th2 as the basis for allergic diseases. In this case, there is a special exception for helminth infections where suppression of allergic reactions occurs due to regulatory network activity (Nadif *et al.*, 2014).

Extensive studies on eosinophils have revealed their contribution to host defense, immunomodulation, tissue remodeling and fibrosis, and in immunoregulatory and anti-inflammatory processes. The recruitment of eosinophils is related to the release of cytokines, chemokines and others products such as IL-3, IL-4, IL-5, IL-13, CCL11, CCL24, CCL26, TNFα, integrins, and histamine, released from different cells involved in the disorders (Nadif et al., 2014).

Eosinophils develop in the bone marrow from hematopoietic stem cells. During hematopoiesis, myeloid progenitor produces CD34+ IL-5Rα+ eosinophils progenitor which numbers will increase in some diseases such as allergies and worm infections. This shows that an increase in eosinophil progenitors is important in diseases associated with eosinophilia (Fulkerson & Rothenberg, 2013).

We conducted the ENT examination, routine blood tests, and routine stool examination of the students in Alwasliyah Berastagi Elementary School as a partner of community service. The result will present the distribution of allergic rhinitis, eosinophilia, and helminth infection and whether there is an association between allergic rhinitis and eosinophilia in helminth infection. The education about allergic rhinitis, eosinophilia, and helminth infection to the delegation of the students was done to increase the knowledge about the disease.

2. METHODS

The implementation method offered from the community service program is divided into several stages including review of partner area locations, education about allergic rhinitis, eosinophilia, and helminth infection and health examination to get the distribution of the diseases in the students. The materials of education were about the association between allergic rhinitis and eosinophilia in helminth infection which includes the definitions, etiology, clinical manifestations and how to prevent the disease. We did the ENT examination, routine blood tests, and routine stool examination to the students.

3. RESULT AND DISCUSSION

ENT examinations, routine blood tests, and routine stool examination was conducted in Alwasliyah Berastagi Elementary School. Table 1 show the characteristics of the students in the partner of community service.

Characteristics	n	%
Gender		
Male	23	53.5
Female	20	46.5
Age (years old)		
8	1	2.3
10	4	9.3
11	19	44.2
12	18	41.9
13	1	2.3

Table 3.1. Characteristics of Students in Alwasliyah Berastagi Elementary School (n=43)

Based on table 3.1, among 43 students, the male students was more than female with (53.5% vs 46.5%). The students was mostly in 11 and 12 years group of age with 19 and 18 students (44.2%, 41.9%).

Routine Blood Test's Result	N	%
Eosinophils count		
Elevated	8	19.5
Normal	33	80.5
Leukocyte count		
Elevated	0	0
Normal	41	100
Hemoglobin		
Elevated	0	0

Normal	41	100

Table 3.2. Distibution of Students in Alwasliyah Berastagi Elementary School based on Routine Blood Test's Result (n=41)

Table 3.2 showed that among 41 students that took the routine blood test, most of the students were not eosinophilia (80.5%) with only 19.5% of the students were eosinophilia (cut-off point: 6). Both leukocyte count and hemoglobin of all 41 students was normal.

Allergic Rhinitis	**N**	**%**
ENT Examination		
Positive	23	53.5
Negative	20	46.5
SFAR score		
≥7	6	14
<7	37	86

Table 3.3. Distibution of Allergic Rhinitis among Students in Alwasliyah Berastagi Elementary School (n=43)

It was shown in table 3.3 that based on the ENT examination result, there were 23 students with positive allergic rhinitis (53.5%) while based on Score for Allergic Rhinitis (SFAR), there were more students with <7 score which means that they were negative for allergic rhinitis (86%). This different result of both methods may be due to a different levels of knowledge among students while answering the questionnaire or other factors related to recall of memory about the subjects' symptoms.

Helminth Infection	**N**	**%**
Positive	3	13
Negative	20	87

Table 3.4. Distribution of Students in Alwasliyah Berastagi Elementary School based on Routine Stool Examination's Result (n=23)

Table 3.4 show the results of routine stool examination with negative results as the most common finding in all of the students (87%) with only 13% of the students with positive helminth infection. This finding is higher than the previous study conducted in Medan where the prevalence of helminth infection among elementary school students is 7.6% (Arrasyid *et al.*, 2017). This may be due to the different characteristics of the subjects and a smaller group of subjects conducted in this study.

We educated 43 students in Alwasliyah Berastagi Elementary School as the delegation of each class about the association between allergic rhinitis and eosinophilia in helminth infection. Before we educate the students, we gave a questionnaire about allergic rhinitis, eosinophilia, and helminth infection to the students. We also gave another exact questionnaire after we educate them. Before the education, among 43 students, there were 34 students (79.1%) with a corrected answer that we classify as good knowledge and 9 students (20.9%) with poor knowledge. After education, there were 40 students (93%) with good knowledge and only 3 students (7%) with poor knowledge. The questionnaire result shows that there were more students with a corrected answer that we classify as good knowledge after they were educated than before they were educated. (93% vs 79.1%) as shown in Table 3.5.

Knowledge	**N**	**%**
Before Education		
Good Knowledge	34	79.1
Poor Knowledge	9	20.9
After Education		
Good Knowledge	40	93
Poor Knowledge	3	7

Table 3.5. Distibution of Knowledge among Students in Alwasliyah Berastagi Elementary School (n=43)

	Eosinophils Count				
	Elevated	%	Normal	%	P value
Allergic Rhinitis					
Positive	5	22.7	17	77.3	0.587
Negative	3	15.8	16	84.2	
Helminth Infection					
Positive	1	33.3	2	66.7	0.458
Negative	3	15	17	85	

Table 3.6. Distribution of Allergic Rhinitis among Students in Alwasliyah Berastagi Elementary School (n=43)

Table 3.6 presented the prevalence of allergic rhinitis, eosinophilia, and helminth infection among the students according to age and gender. Most of the allergic rhinitis were among the age group of 11 and 12 years with 52.2% and 47.8%. Based on gender, females had a higher prevalence of allergic rhinitis with 60.9%. This finding correlates with another study where the majority of the allergic respira¬tory cases were of age group 8-12 years accounting 49%. The previous study also found the incidence of the allergic disorder is more common in male compared to female (60% vs 40%) (Sonawane et al., 2016).

Among all students, the prevalence of eosinophilia in the age group of 11 and 12 years was higher than other age groups (37.5%). Sixty-five percent of the eosinophilia cases were found in male students. The prevalence of helminth infection was higher in 10 and 12 years group of age with 66.7% and 33.3%. This finding also shows that the prevalence of helminth infection is higher in male than female students (66.7% vs 33.3%). This finding is not correlated with the previous findings held in Medan where the prevalence of helminth infection was higher among ≤10 years children compared to >10 years children and higher prevalence in girls than boys (Arrasyid *et al.*, 2017). This may be due to the different characteristics of the subjects involved in both studies. However, this finding is correlates to the previous study held in Bali where the prevalence of elementary school students infected with the helminth infection is higher in male than in female students (61.2% vs 23.7%)(Wiryadana *et al.*, 2018).

Variable	**Allergic Rhinitis n(%)**	**Eosinophilia n(%)**	**Helminth Infection n(%)**
Age			
8	0/0	0/0	0/0
10	0/0	1/12.5	2/66.7
11	12/52.2	3/37.5	0/0
12	11/47.8	3/37.5	1/33.3
13	0/0	1/12.5	0/0
Gender			
Male	9/39.1	5/62.5	2/66.7
Female	14/60.9	3/37.5	1/33.3

Table 3.7. Cross-tabulation between Eosinophilia, Allergic Rhinitis, and Helminth Infection among Students in Alwasliyah Berastagi Elementary School

In Table 3.6 of cross-tabulation, students with allergic rhinitis with elevated eosinophils count were 22.7% (5/22), students with allergic rhinitis with normal eosinophils count were 77.3% (17/22). There are 15.8% of students with negative allergic rhinitis and elevated eosinophil count

and the remaining 84.2% (16/19) students had negative allergic rhinitis with normal eosinophil count. This finding correlates with the previous study where the blood eosinophil count was higher in allergic rhinitis group compared to the nonallergic rhinitis group (n=191 vs n=149) (Min et al., 2016).

Students with helminth infection with elevated eosinophil count were 33.3% (1/3) while the remaining 66.7% (2/3) students had positive helminth infection with normal eosinophil count. There are 15% (3/20) students with negative helminth infection and elevated eosinophil count, and 85% (17/20) students with negative helminth infection and normal eosinophil count.

Statistical analysis shows no significant association between both allergic rhinitis and helminth infection and eosinophilia ($p = 0.587$ and $p = 0.458$, $p > 0.05$). This finding is not correlated with the previous finding held in Korea where there is a significant correlation between allergic rhinitis and eosinophilia with p value 0.002 (Min et al., 2016). This finding is also not correlated with another study conducted in Elementary School in Medan where there was a significant correlation found between parasite infection and eosinophil and the risk of STH infection that caused eosinophilia or increased eosinophil levels in the children with p value 0.021 (Darlan *et al*., 2017). This might be due to the different characteristics of the subjects in both studies.

4. CONCLUSION

Allergic rhinitis was more common in 11 and 12 years group of age among students in Alwasliyah Berastagi Elementary School accounting 52.5% and 47.8% and its prevalence is higher in females than male students (60.9% vs 39.1%). The prevalence of both eosinophilia and helminth infection found in this study is higher in male students accounting 62.5% and 66.7%. The prevalence of eosinophilia is higher among 10-12 years old age group with 12.5% for 10 years old age group and 37.5% for both 11 and 12 years old age group. The highest prevalence of helminth infection is in 10 years old age group accounting 66.7% and 12 years old age group with 33.3%. According to this study, there is no significant association between both allergic rhinitis and helminth infection and eosinophilia ($p = 0.587$ and $p = 0.458$, $p > 0.05$). A larger group of subjects is needed in further study.

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REFERENCES

Arrasyid, N.K., Sinambela, M.N., Tala, Z.Z., Darlan, D.M., et al. (2017*) Correlation between Soil-Transmitted Helminths Infection and Serum Iron Level among Primary School Children in Medan*. 1–4.

Darlan, D.M., Tala, Z.Z., Amanta, C., Warli, S.M., et al. (2017) Correlation between Intestinal Parasite Infection and Eosinophil Levels among Primary School Children in Medan. *Open Access Macedonian Journal of Medical Sciences*. [Online] 5 (2), 142–146. Available from: doi:10.3889/oamjms.2017.014.

Dykewicz, M.S. & Hamilos, D.L. (2019) Rhinitis and sinusitis. *Journal of Allergy and Clinical Immunology*. [Online] 125 (2), S103–S115. Available from: doi:10.1016/j.jaci.2009.12.989.

Fulkerson, P.C. & Rothenberg, M.E. (2013) Targeting Eosinophils in Allergy, Inflammation and Beyond. *Nat Rev Drug Discov*. [Online] 12 (2), 1–23. Available from: doi:10.1038/nrd3838.Targeting.

Mallol, J., Crane, J., Mutius, E. Von, Odhiambo, J., et al. (2013) *The International Study of Asthma and Allergies in Childhood (ISAAC) Phase Three : A global synthesis*. 41 (2).

Min, H.J., Hong, Y.H., Yang, H.S. & Kim, K.S. (2016) The correlation of serum eosinophil cationic protein level with eosinophil count, and total IgE level in Korean adult allergic rhinitis patients. *Asian Pacific Journal of Allergy and Immunology*. [Online] 34 (4), 290–294. Available from: doi:10.12932/AP0739.

Min, Y. (2010) *The Pathophysiology , Diagnosis and Treatment of Allergic Rhinitis*. [Online] 2 (2), 65–76. Available from: doi:10.4168/aair.2010.2.2.65.

Nadif, R., Zerimech, F., Bouzigon, E., Matran, R., et al. (2014) *The role of eosinophils and basophils in allergic diseases considering genetic findings* . To cite this version : HAL Id : inserm-00880260.

Small, P., Keith, P.K. & Kim, H. (2018) Allergic rhinitis. *Allergy, Asthma & Clinical Immunology*. [Online] 14 (s2), 1–11. Available from: doi:10.1186/s13223-018-0280-7.

Sonawane, R., Ahire, N., Patil, S. & Korde, A. (2016) *Study of Eosinophil Count in Nasal and Blood Smear in Allergic Respiratory Diseases*. [Online] 3 (January), 44–51. Available from: doi:10.18311/mvpjms/2016/v3i1/738.

Wiryadana, K.A., Putra, I.W.A.S., Rahayu, P.D.S., Pradnyana, M.M., et al. (2018) Risk factors of soil-transmitted helminth infection among elementary school students. *Paediatrica Indonesiana*. [Online] 57 (6), 295. Available from: doi:10.14238/pi57.6.2017.295-302